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(72) (74) continued overleaf

(54) **Sensory system**

(57) A prosthetic visual or aural sensing system has light or sound sensing means 10 providing a sequence of electrical signals, a store 18 to store the signals, read means 17, 19, 20, 21 for reading out the stored information in a sequence which differs from the write sequence, and an implant including electrodes 37 contacting the brain cortex and means to stimulate electrodes 37 sequentially in dependence on the signals read from store 18. The read/write sequence difference is provided by a PROM 21 controlling the write or read address sequence of store 18 and allows non-critical positioning of electrodes 37 since it can be programmed to stimulate the most appropriate electrodes so that a coherent picture is produced. Sensor 10 and electrodes 37 may each comprise a matrix of from 256 to 5000 elements. Data signals, power, and clock pulses may be coupled to the implant inductively. Sensing means 10 may be provided by a hand camera or built into spectacles or implanted. The video data fed to store 18 may define only black or white levels, or also intermediate grey levels.

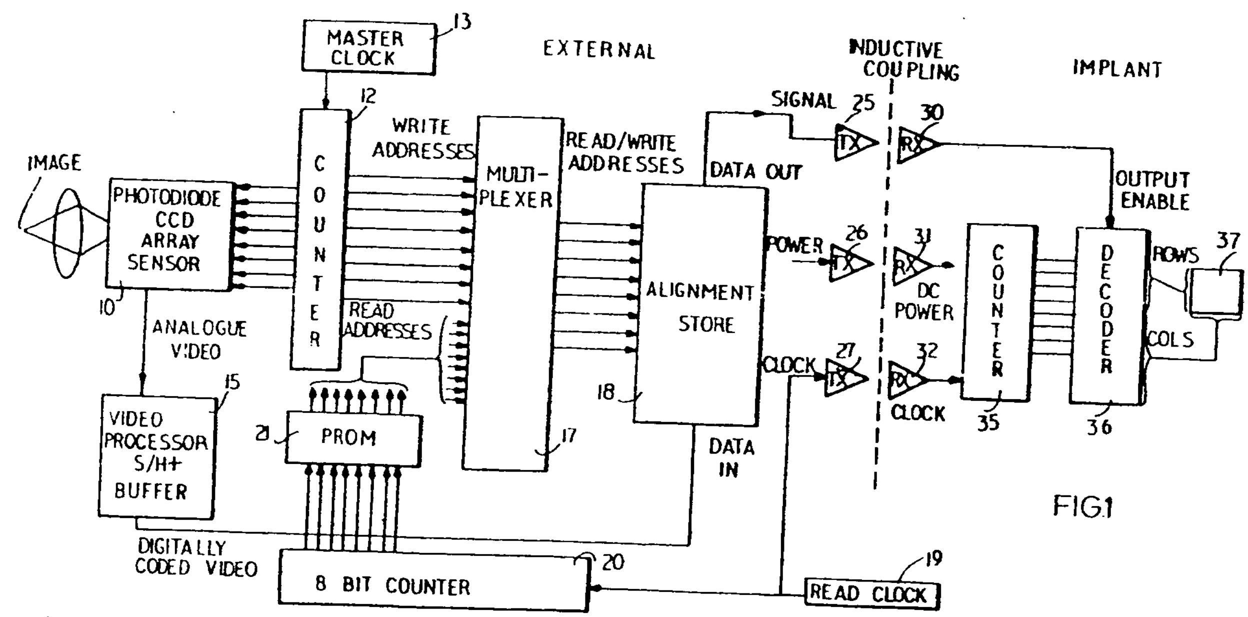

FIG1

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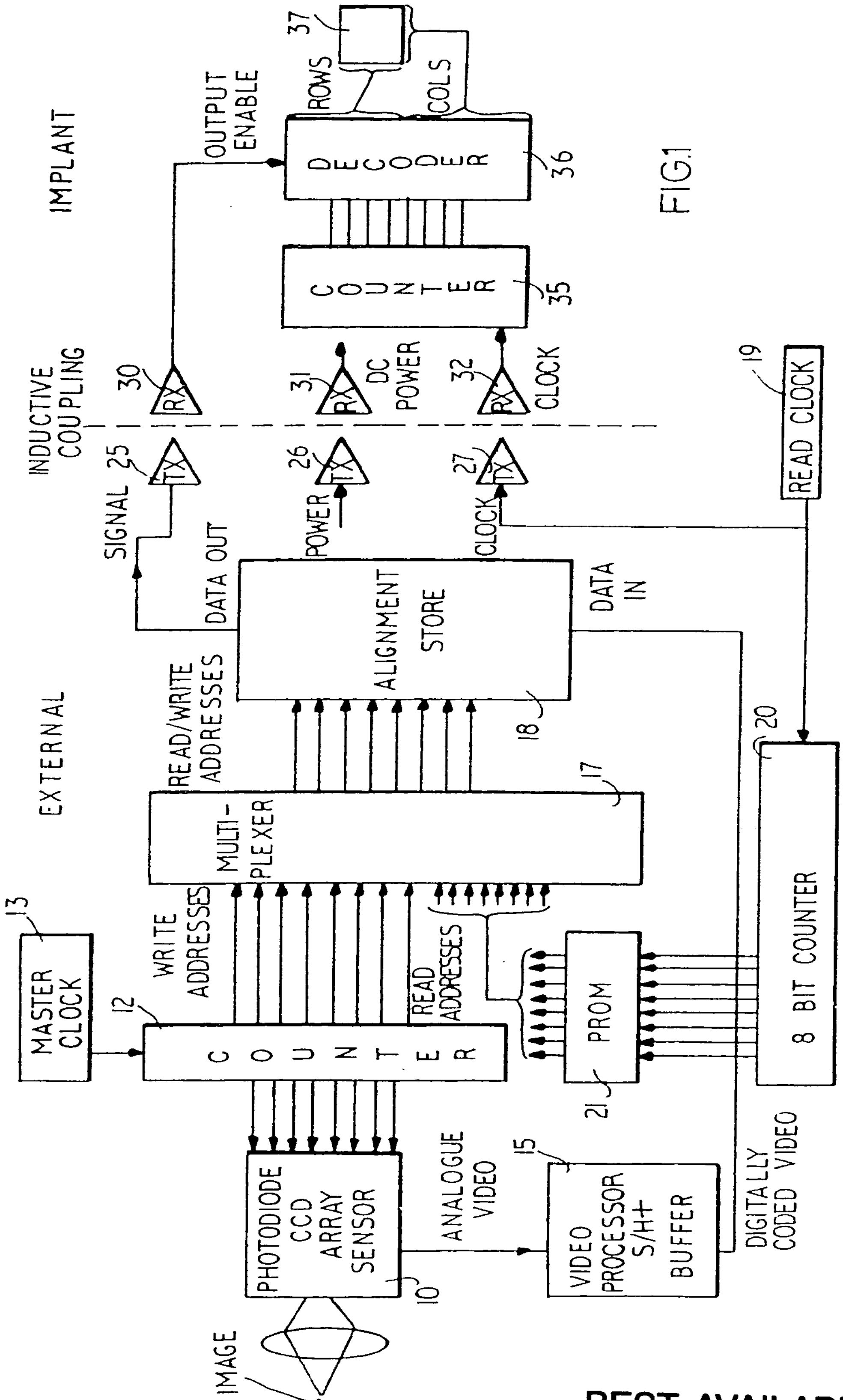

FIG.1

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SPECIFICATION

Sensory system

The invention relates to a system for producing a prosthesis of a sensory organ by electrical stimulus of the appropriate part of the brain.

In known systems (see for example Artificial Vision Progresses by T.E. Ivall, Wireless World, April 1975) contact with the exterior of the cortex of the brain is used to produce external stimulation which can be unreliable and requires very precise positioning of the electrodes to enable the desired excitation of a particular portion of the cortex to be effected.

According to the invention there is provided a sensory system comprising sensing means for providing a plurality of electrical signals in dependance upon information detected thereby; storage means having a plurality of locations therein for storing the electrical signals from said sensing means in a predetermined sequence; read out means for reading out said stored information in a predetermined sequence which differs from the sequence used to write in said information to said storage means; and implant means including a plurality of terminal means capable of being positioned so as to contact the brain cortex to stimulate the brain in dependence upon the signals read out from said storage means.

Preferably the terminal means are positioned so as to be located within the brain cortex.

The invention will now be described by way of example with reference to the accompanying drawings in which:

Figure 1 shows one embodiment of the sensory system of the invention, and

Figure 2 shows one arrangement for positioning the inplant arrangement.

The sensing system shown in Fig. 1 includes an image sensor 10 which has a matrix of sensor elements (e.g. photodiodes with associated charge coupled devices) therein. The matrix may comprise 16 × 16 elements (256) each addressable by means of an 8 bit word defining their respective addresses (e.g. type 1PL 2DI). The 8 bit addressing is provided by the output of a counter 12 (e.g. MC 14520) which cycles the addresses at a rate controlled by a master clock generator 13 (e.g. 14069).

The voltage produced by the sensor 10 at a particular location when addressed is received by a video processor 15 which may include a sample/hold circuit and a comparator. The sample voltage held by this circuit is compared with a reference level so as to produce a binary output from the comparator (1 bit) which will be high or low depending on the amount of light received by that particular sensor element. The data from processor 15 is received and stored in alignment store 18 (e.g. MC 14537). The store locations are addressed in dependence on counter 12 which provides the write address cycle via a multiplexer 17. The multiplexer (e.g. 14053) is provided so that the write and read addressing of the store 18 can be shared on common lines and will accomodate an incoming (write) data rate different to an outgoing (read) data rate. The read address for the store 18 is derived from a counter 20 (e.g. 14520) under the control of a read clock generator 19. The read addresses are not passed directly to the multiplexer 17 but are received by a programmable read only memory (PROM) 21 (e.g. Intel 1702A). The counter 20 will address a particular location within the PROM which will produce an 8 bit word stored therein which will effectively define a different address to be accessed in the alignment store 18. Thus although the counter 20 will provide sequential store location addressing during a cycle, the PROM 21 will produce a different sequence of addressing of the store 18 in dependance on how the PROM has previously been programmed. The reason for providing non-sequential store location addressing will be explained below.

The data read out from the store in dependance on the read addressing is passed to a transmitter element 25 (e.g. an inductance) which is coupled to a receiver element 30 forming part of an implant circuit. Similar transmitter elements 26, 27 are provided for power and read clocks respectively and are coupled to receivers 31 and 32 respectively. The clock pulses from receiver 32 are received by a counter 35 (e.g. 14520) which produces an 8 bit parallel output. This output is received by a decoder 36 (e.g. 14514) which decodes the inputs to 2 × 16 lines which effectively define the row and column locations of an electrode matrix 37 implanted so as to contact a portion of the brain cortex. The matrix comprises 16 rows and 16 columns (i.e. 256 electrodes). A particular electrode is addressed via the decoder 36 and will be energised if an output enable pulse is received from receiver element 30. The output enable pulse corresponds to the 1 bit data signal from a particular location within the store 18. As this data signal was derived from the image sensor 10, the output enable signal will only be produced when a sufficient light level had been detected from that element of the sensor. When an electrode is addressed without an output enable pulse being received, no energising pulse will be produced for that particular electrode.

The electrodes 37 are actually implanted within the visual cortex so that the phosphenes within the brain are directly excited when the electrodes are energised. This is superior to contacting the exterior of the cortex to produce 'flashes'' of light (phosphenes). Each electrode would typically comprise an

dressing of the digital store to be effected on common addressing lines.

7. A system as claimed in any one of claims 1 to 6, wherein inductive coupling means are provided to couple the signals read out from said storage means to the implant means.

8. A system as claimed in any one of claims 1 to 7, wherein said sensing means includes an array of elements sequentially addressable, and said implant means includes a sequentially addressable decoder capable of providing a stimulation signal for the terminal means identified by the decoder in dependence on the signal read out from said storage means.

9. A system as claimed in any one of claims 1 to 8, wherein said sensing means comprise light sensors.

10. A system as claimed in any one of claims 1 to 8, wherein said sensing means comprise sound sensors.

11. A sensor system substantially as described herein and with reference to the accompanying drawings.

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